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The effects of construction delays on project delivery in Nigerian construction industry

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Abstract

Construction delay has become endemic in Nigeria. It is imperative to create awareness of the extent to which delays can adversely affect project delivery. This paper identifies, by questionnaire evaluates and through empirical method assesses the effects of construction delays. The findings showed that time and cost overruns were frequent effects of delay. Delay had significant effect on completion cost and time of 61 building projects studied. Client-related delay is significant in Nigeria. Acceleration of site activities coupled with improved clients' project management procedure and inclusion of appropriate contingency allowance in precontract estimate should assuage the adverse effect of construction delays.

Keywords: Managing projects; Cost; Time; Claims

1. Introduction

The Nigerian construction industry continues to occupy an important position in the nations economy even though it contributes less than the manufacturing or other service industries. The contribution of the construction industry to national economic growth necessitates improved efficiency in the industry by means of cost-effectiveness and timelines and would certainly contribute to cost savings for the country as a whole.

A major criticism facing the Nigerian construction industry is the growing rate of delays in project delivery. Delay is a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. In countries such as United State of America (USA), United Kingdom (UK) and Western Germany, Mobbs [1] found that 'construction time' is better. In Nigeria, Ajanlekoko [2] observed that the performance of the construction industry time wise is poor. An investigation by Odeyinka and Yusif [3] shows that seven out of ten projects surveyed suffered delays in their execution. According to Chan and Kumaraswamy [4] timely delivery of projects within budget and to the level of quality standard specified by the client is an index of successful project delivery.

When projects are delayed, they are either accelerated or have their duration extended beyond the scheduled completion date. These are not without some cost consequences. The conventional approach to managing the extra cost is to include a percentage of the project cost as contingency in the pre-contract budget. According to Akinsola [5] conventional allocation of contingency is based on judgment. However construction projects are unique, as they may have a distinctive set of objectives, require the application of new technology or technical approaches to achieve the required result. This uniqueness makes the contingency allowance allocation based on assumption and intuition inadequate and unrealistic. An investigation by the authors revealed that in Nigeria 5–10% of precontract estimate is in most cases allowed as contingency. This allowance was found to be inadequate. Inadequate contingency implies extra financial commitments, which in some cases are beyond the capacity of the owner. Clients are in some cases not

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prepared for such extra cost and so fund inform of loan are sought to offset the unexpected costs.

Furthermore, associated delay problems can also result in dispute, arbitration, total abandonment and protracted litigation by the parties. To some extent the contract parties through claims usually agree upon the extra cost and time elongation associated with delay. Nevertheless, this has in many cases given rise to heated arguments between the owner and contractor. The question of whether a particular delay to progress of work warrants an extra cost and or extension of project duration is usually the cause of disagreement. Such situations, usually involve questioning the facts, causal factors and contract interpretation, which have been addressed by Alkass et al. [6]; and Bordoli and Baldwin [7]. In specific terms, Mansfield et al. [8]; and Odeyinka and Yusif [3] have addressed the causes of delays in Nigeria building projects. Important causes of delay identified by Mansfield et al [8] are: financing of and payment for completed works, poor contract management, changes in site condition and shortages in materials. Odeyinka and Yusif [3] classified the causes of delay via project participants and extraneous factors. Client-related delays identified include variation orders, slow decision-making and cash flow problems while contractor-related delays include financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems and shortage of manpower. Extraneous causes of delay identified were inclement weather, Acts of God, labour disputes and strikes.

However, while there seems to be a consensus as regards the causes of construction delays in Nigeria, impact of delay, on the other hand is an area in which little research has been carried out. There is need for awareness in the Nigerian construction industry on the changes delay can impose on project delivery. In this regard, a major aspect of this study is to empirically investigate the effect of delay on two key variables of project delivery namely completion cost and time. The question of how the effects of delays can be buffered will also be addressed.

Based on all this foregoing, the intention of this paper therefore is:

1. To identify and evaluate the effects of delays on building project execution in Nigeria.
2. To assess the effects of delay on completion cost of building projects.
3. To assess the effects of delay on completion time of building projects.
4. To investigate how the effects of delays can be minimized.

The results of the study would lead to recommendations aimed at reducing the impact of delay on project delivery. It was also believed that the study would not only clarify but also create an awareness of the extent to which delay can adversely affect project delivery.

2. Analysis of questionnaire survey of the effects of construction delay in Nigeria

2.1. Methodology

From existing literature on the construction industry in Nigeria and based on the preliminary investigation conducted at the outset of this study, it was possible to identify certain major effects of delay on project delivery. The six effects of delay identified were: time overrun, cost overrun, dispute, arbitration, total abandonment and litigation. A questionnaire was then drawn up and was divided into two sections. Section A sought to know the general particulars of the respondents while section B was focused on the six identified effects of construction delays.

The respondents were asked to rank the individual effect of construction delays based on frequency of occurrence according to their own judgment and local working experience in the Nigerian construction industry between 1990 and 1999. The authors adopted a scale of 0–4 for the ranking exercise. To facilitate the analysis of the responses, the following numerical values were assigned to the respondents' ratings (after Al-Hammad [9] and Assaf et al. [10]): 'Always'—4, 'Mostly'—3, 'Sometimes'—2, 'Seldom'—1 and 'Never'—0. The stratified random sampling technique was used. The questionnaires were sent to three groups of construction practitioners viz. quantity surveyors, architects/engineers and contractors. The practitioners were from firms located within southwestern Nigeria, which comprise six states including Lagos (the former capital of Nigeria). The firms were selected from a numerical list of firms in the geographical area drawn by the authors. Systematic sampling techniques were adopted in the selection. This according to Leedy [11] minimizes bias. Based on the result of tossing of a coin, the selection was commenced with the first number in the arithmetic progression of odd numbers.

Two hundred (200) firms were selected and were given the questionnaires and 102 were returned representing a response rate of 51% (Table 1). This was considered adequate for the analysis based on the assertion by Moser and Kalton [12] that the result of a survey could be considered as biased and of little value if the return rate was lower than 30–40%. Eighty-three percent of the respondents are either HND or BSc holders and 86.27% of them are professionally registered. The average years of experience of the respondents stands at 22 years while on the average the respondents had handled 32 projects up to 1999.

2.2. Presentation and analysis of results from questionnaire survey

Chan and Kumaraswamy [13] and Kometa et al. [14] used the 'relative importance index' method. This method was also adopted to analyze the data collected from the questionnaire survey. The analysis was carried out for each group of respondents (quantity surveyors, architects/engineers and contractors). The five-point scale 0–4 mentioned earlier was transformed to relative importance indices for each of the six effects of construction delays. The indices were then used to determine the rank of each item. These rankings made it possible to cross compare the relative importance of the items as perceived by the three groups of respondents. The weighted average for each item for the three groups of respondents was determined and ranks (R) were assigned to each item representing the perception of the three groups. The relative importance index (RII) was calculated for each item as follows (after Lim and Alum [15]):

$$\mathrm{RII} = \frac{4n1 + 3n2 + 2n3 + 1n4 + 0n5}{4N}$$

where $n1$ = number of respondents for 'Always'; $n2$ = number of respondents for 'Mostly'; $n3$ = number of respondents for 'Sometimes'; $n4$ = number of respondents for 'Seldom'; $n5$ = number of respondents for 'Never'; N = Total number of respondents.

Based on the ranking (R) of the weighted average of the relative importance indices (RII) for the three groups (see Table 2), it was observed that the most frequent effects of delay on building project delivery in Nigeria were time overrun (RII = 0.786) and cost overrun (RII = 0.671). They were followed by dispute (RII = 0.456), total abandonment (RII = 0.456), arbitration (RII = 0.355) and litigation (RII = 0.296). The high ranks assigned to time and cost overrun were not unexpected. Firstly, on most sites in Nigeria when an activity on the critical path of construction programme is delayed, it impacts the start and completion date of subsequent activities and this lead to overall time schedule slippage of project. According to information gathered from the respondents during the survey when acceleration is introduced, they are ineffective as a result of reoccurrence of delay. This will be addressed later in this paper. Secondly, delay caused by a client or its agents generates additional costs to be borne by the client in the form of claims. The claims cover cost of plant and labour inefficiency as a direct result of the delay, increases in cost occurring during the period of delay and increases in head office overheads. It is therefore not surprising that cost overrun is a frequent effect of delays in Nigerian building projects. Furthermore, the low ranks assigned to dispute, total abandonment, arbitration and litigation were not unexpected. Claiming for additional expenses and or extension of time in cases of delay is usually through the process of claims presentation (Clause 26 of JCT, 1980 and Clause 24 of JCT, 1980). The presentation of claim according to Jagboro and Alli [16] may generate dispute between the parties and can lead to arbitration process. Where the arbitration process fails, litigation may result and may eventually lead to total abandonment of project. Dispute, arbitration, litigation and total abandonment of projects can be averted under good management of contractual claims. It is therefore not surprising that these effects of delay were ranked low.

Table 1
Questionnaire distribution and response

Description	Number distributed	Number of respondents	% of number distributed	% of number of responses
Quantity Surveyors	90	46	51	45
Architects/ Engineers	50	21	42	21
Contractors	60	35	58	34
Total	200	102	51	100

3. Empirical analysis of the effects of construction delays in Nigeria.

3.1. Methodology

In order to empirically investigate the effects of construction delay, time and cost effects of delay were selected for further analysis. For the purpose of the investigation cost data were obtained in respect of Nigerian building projects, which were completed between 1990 and 1999. A data collection proforma designed for this purpose was employed. The quantity surveying and contracting firms selected in the questionnaire survey were asked to complete the proforma.

Table 2
Relative importance indices (RII) and ranks (R) of six effects of construction delays as perceived by the three groups of respondents in Nigeria

Effects of delay	Quantity Surveyors		Architects/ Engineers		Contractors		Weighted average (all groups)	
	RII	R	RII	R	RII	R	RII	R
Time overrun	0.799	1	0.774	1	0.786	1	0.786	1
Cost overrun	0.728	2	0.607	2	0.679	2	0.671	2
Dispute	0.419	4	0.441	4	0.507	3	0.456	3.5
Arbitration	0.370	5	0.345	5	0.350	5	0.355	5
Litigation	0.277	6	0.274	6	0.336	6	0.296	6
Total abandonment	0.495	3	0.452	3	0.421	4	0.456	3.5

The information obtained include the following: project type, initial contract sum, estimated project duration, start date, actual completion date, number of floors, gross floor area, final account sum, loss and expense claims arising from delays and fluctuation claim during delay period. At the end of the collection exercise, information on 70 completed building projects were obtained out of which 61 were found complete and fit for analysis. Most of the projects were residential buildings (33) and were followed by commercial/office buildings (23) and educational buildings (5). The cost data obtained were adjusted to 1990 prices using the Consumer Price Index (CPI) obtained from the Federal Office of Statistic. The adjustment was carried out using the cost adjustment formula:

$$\text{Adjusted cost data} = \frac{\text{Index in base year/month}}{\text{Index in year/month of data}} \times \text{cost data}$$

The adjustment was necessary because the projects were all tendered for during the period 1990–1999 and the effect of inflation and competition had to be eliminated in order to ensure a homogenous cost comparison. Following the adjustment, the projects were classified based on initial contract value into those ranging from 0 to 10 million Naira and 10 million Naira and above.

In order to examine the effect delay on completion cost, the following variables were identified: initial contract sum (X), final account sum (Y), loss and expense claim (Le) and fluctuation claim during delay period (Fcd). Loss and expense claim is an indication of additional expenditure by the client as a result of ascertained and approved delays (Clause 26 of JCT, 1980). The effect of loss and expense claim (Le) on project cost overrun (Co){derived from Final account sum (Y)−Initial contract sum (X)} was investigated on one hand. On the other hand, the effect of fluctuation claim (Clause 39 of JCT, 1980) during delay period on project cost overrun was also investigated.

Simple linear regression analyses of cost overrun (Co) on loss and expense claim (Le) and of cost overrun (Co) on fluctuation claim during delay period (Fcd) were performed using the statistical package for social sciences (SPSS). Regression equation and calculated values of test statistic F and the level of significance of association between the variables were computed at 5% significance level. The statistic R^2 (coefficient of determination) obtained measured how well the regression model actually fits, or its goodness of fit. If all the observation falls on the regression line, R^2 is 1. If there is no linear relationship between the dependent and independent variables, $R^2 = 0$. R^2 value is widely accepted to be an indicator of how well the regression model fits the population. The model usually does not fit the population as well as it fits the sample from which it is derived. The statistic adjusted R^2 attempts to more realistically reflect the goodness of fit of the regression equation in the population. The value of R^2 indicates the proportion of the variation in the dependent variable explained by the independent variable.

The effect of delays on completion time was also investigated based on the classification mentioned earlier. A simple linear regression analysis of actual project duration was performed on the delay period. Regression equation and calculated values of test statistics F and the level of significance of association between the variables were also computed at the 5% significance level.

3.2. Presentation and analysis of results from the empirical study

The regression equations, coefficient of determination (R^2) and F values obtained from regression analysis of cost overrun (Co) on loss and expense claim (Le) arising from delay are shown in Table 3 for projects of varying sizes and magnitude. The results showed that loss and expense claim arising from delays had significant effect on cost overrun of building projects. The coefficient of determination R^2 were found to be 0.36 and 0.64 for projects ranging from 0 to 10 million and 10 million Naira and above respectively. These implies that 36 and 64% of the variations in cost overrun of the respective project categories can be explained by loss and expense claim. Loss and expense claim arises from approved and ascertained delays caused by the client and or his agents. The significance of loss and expense claims suggests that client-related delays are significant in Nigerian building projects. This corroborates the findings of Odeyinka and Yusif [3], which showed that client-caused delay contributes significantly to overall delay on Nigerian projects. The result is therefore not surprising.

In the case of fluctuation claim during delay period (Fcd) and cost overrun (Co), the relationship was found to be significant (see Table 4). The coefficient of determination R^2 was found to be 0.55 for projects ranging from 0 to 10 million Naira and 0.80 for projects of 10 million Naira and above. These results imply that 55 and 80% of the variation in cost overrun of the respective project categories can be explained by fluctuation claim during the delay period. Fluctuations in price have been on the increase in Nigeria. Jagboro [17] posited that the market situation associated with construction resources in Nigeria is such that unpredictable influence of inflation trend can make the initial construction cost outdated by the time projects are actually completed. The government deregulation policies aimed at liberalising the economy since 1986 are responsible for the instability in prices. It is therefore not surprising that fluctuation claims during the delay period also contribute significantly to cost overrun.

The regression analysis of actual project duration (APD) on delay (manifested by elongation period of projects "EPP") showed that the actual project duration of building projects studied is significantly dependent on the delay period. The regression coefficient of determination (R^2) and F values obtained for projects of varying size and magnitudes are shown in Table 5. The results showed a coefficient of determination R^2 of 0.72 and 0.62 for projects ranging from 0 to 10 million and 10 million Naira and above respectively. These imply that 72 and 62% of the variation in actual project duration can be explained by delays for the respective project categories. It corroborates the result of the questionnaire survey where time overrun was ranked highest as the most frequent effect of delays (Table 2).

Analysis from the data collected for the study further revealed that the average time overrun of the building projects studied were 92.64 and 59.23% of the estimated project duration for projects ranging from 0 to 10 million and 10 million Naira and above respectively. The equations (Tables 3–5) generated serve as benchmarks for future research in studies relating to management of construction projects in Nigeria and also facilitate comparison with other countries.

4. Minimising the effects of construction delays in Nigeria building projects

Based on the findings of his study an investigation was further conducted on how the cost and time effects of delays could be minimised. The two methods identified were acceleration of subsequent site activities to reduce or if possible eliminate time overrun; and inclusion of contingency allowance in precontract estimate to buffer cost overrun.

4.1. Acceleration of site activities

It was gathered from construction practitioners surveyed in this study that in cases of delay of an activity on site subsequent site activities are often accelerated but this frequently failed to make up for the lost time. According to them at the outset of the acceleration process there seems to be progress but due to the deficiency in project management procedure of the clients, the underlying problems responsible for delays remains in force and this often frustrates and renders acceleration ineffective. A major source of deficiency identified as significantly responsible for this is clients continuous issue of design information/variation orders.

4.2. Contingency allowance

Contingency sums are allowances of project cost included in the precontract estimate for the purpose of ensuring that the budget set aside is realistic and sufficient to contain the risk of unforeseen cost increases during construction. The data obtained for this study in respect of 61 completed building projects revealed that the contingency allowances in all the cases were inadequate to offset the cost overrun. Investigation by the authors revealed that 5–10% contingency allowance is a common practice in Nigeria. Provision of adequate

Table 3
Summary of results of regression analysis of cost overrun (Co) on loss and expense claim (Le) for building projects based on initial contract sum classification

Project category	R^2 (adjusted)	Regression equation	F value
0–10 million	0.36	Co = 0.522 + 2.614Le	0.0001 (significant)
10 million and above	0.64	Co = −2.57 + 11.665Le	0.0001 (significant)

Table 4
Summary of results of regression analysis of cost overrun (Co) on fluctuation claim during delay period (Fcd) for building projects based initial contract sum classification

Project category	R^2 (adjusted)	Regression equation	F value
0–10 million	0.55	Co = 0.429 + 2.146Fcd	0.0000 (significant)
10 million and above	0.80	Co = −1.658 + 6.00Fcd	0.0001 (significant)

Table 5
Summary of results of regression analysis of actual project duration (APD) on delay (manifested by elongation period of projects "EPP") for building projects based on initial contractsum classification

Project category	R^2(adjusted)	Regression equation	F value
0–10 million	0.72	APD = 6.468 + 1.075EPP	0.0000 (significant)
10 million and above	0.62	APD = 12.234 + 1.08EPP	0.00001 (significant)

contingency sum at the precontract stage could buffer the extra financial burden arising from project uncertainties. In this regard the percentage cost overrun of completed projects over the initial estimate is a strong parameter for assessing the adequacy of the contingency allowance. The authors were able to estimate from 61 sample cases studied a mean percentage cost overrun of 17.34%. This implies that 17.34% of project cost estimate should be included in the precontract estimate as contingency in Nigerian building projects against the usual practice of between 5 and 10%. The 17.34% contingency allowance estimated in this study falls within the 15–20% allowance recommended by the United States Department of Energy (DOE) for budget estimates of new buildings.

5. Conclusions, recommendations for construction industry practice and areas for further research

The study investigates, firstly by questionnaire survey of construction practitioners, the effects of construction delay on project execution and, secondly, by empirical method, the effects of delay on completion cost and time. Two areas of how the effects of delays can be minimised were also investigated. The main conclusions of the study are as follows:

- Cost overrun and time overrun (elongation of project duration) were the two most frequent effects of delay in the Nigerian construction industry.
- Delay had significant effects on actual project duration. The model relating delay and actual project duration provide a benchmark for future research work in the study of project management in Nigeria and also facilitate comparison with other countries.
- Loss and expense claims arising from delay and fluctuation claims during the delay period had significant effect on cost overrun. The models provide a benchmark for future research work in the study of project management in Nigeria and also facilitate comparison with other countries.
- Loss and expense claims arise from ascertained and approved delay caused by the client or his agent. The significant effect of loss and expense claims on project cost overrun suggests that clients are a significant cause of delay in Nigerian building projects. This corroborates the result of a previous study [3] where client-related delay was found to be significant.
- Acceleration of subsequent site activities in cases of delay to make up for the lost time has frequently failed in Nigeria building projects due to deficiencies in clients project management procedure. In this regard, continuous issue of design information/variation orders by the clients often frustrate the acceleration process. Acceleration has been found to be beneficial in Western Germany [1]. There is a need for an effective clients' project management procedure in Nigeria.
- The contingency sums included in the precontract estimate of projects in Nigeria were not adequate to offset cost overrun. This study was able to establish an allowance of 17.34% of total cost estimate. This figure should however be improved upon by the use of a more comprehensive predictive model which is a subject for further research.

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